



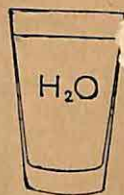
SCIENCE ON THE MARCH

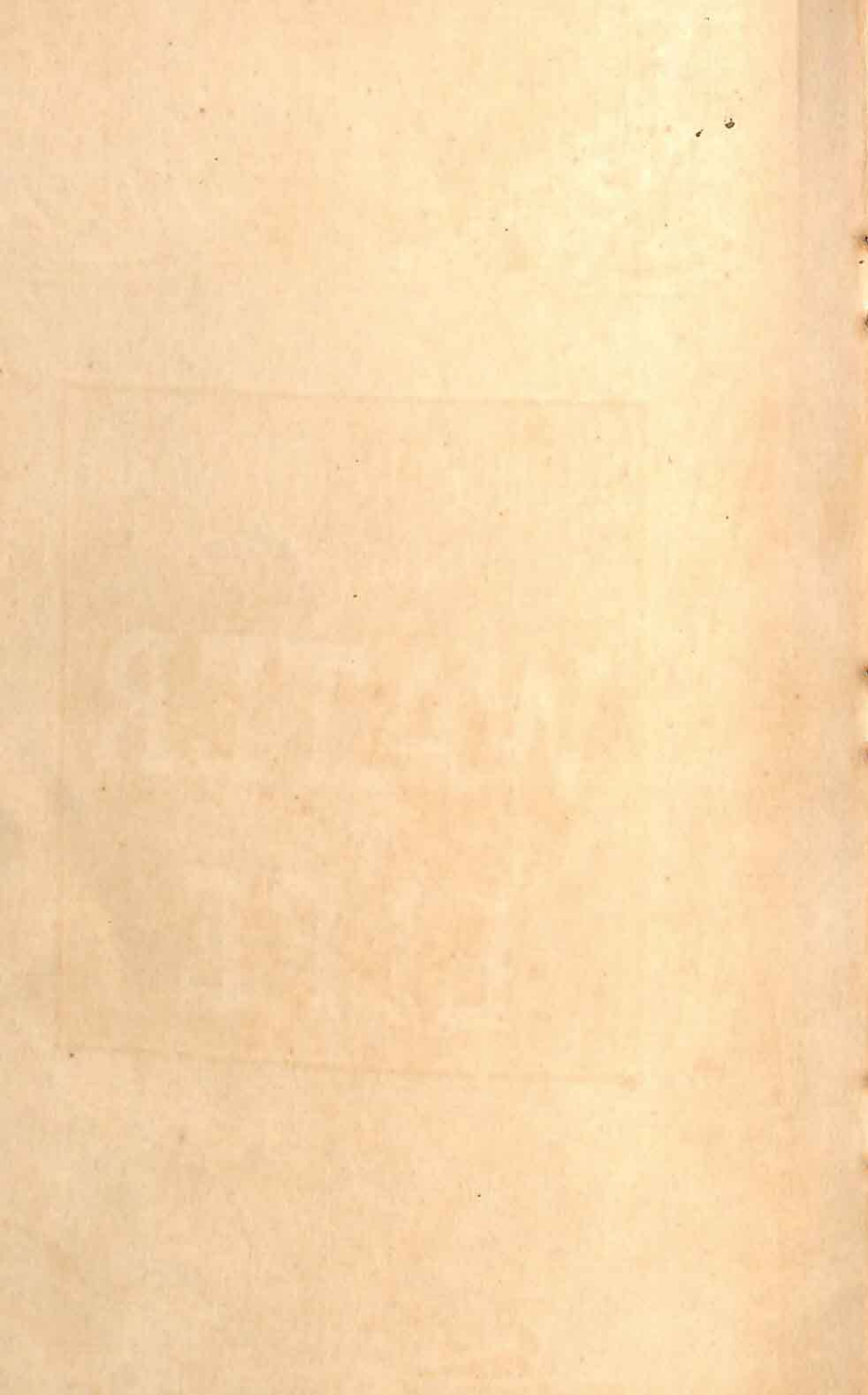
UNIT TWO

WATER

AND

LIFE





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SCIENCE ON THE MARCH
UNIT TWO

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WATER AND LIFE

John A. Clark
Edith Lillian Smith

Frederick L. Fitzpatrick
Charles H. Dobinson



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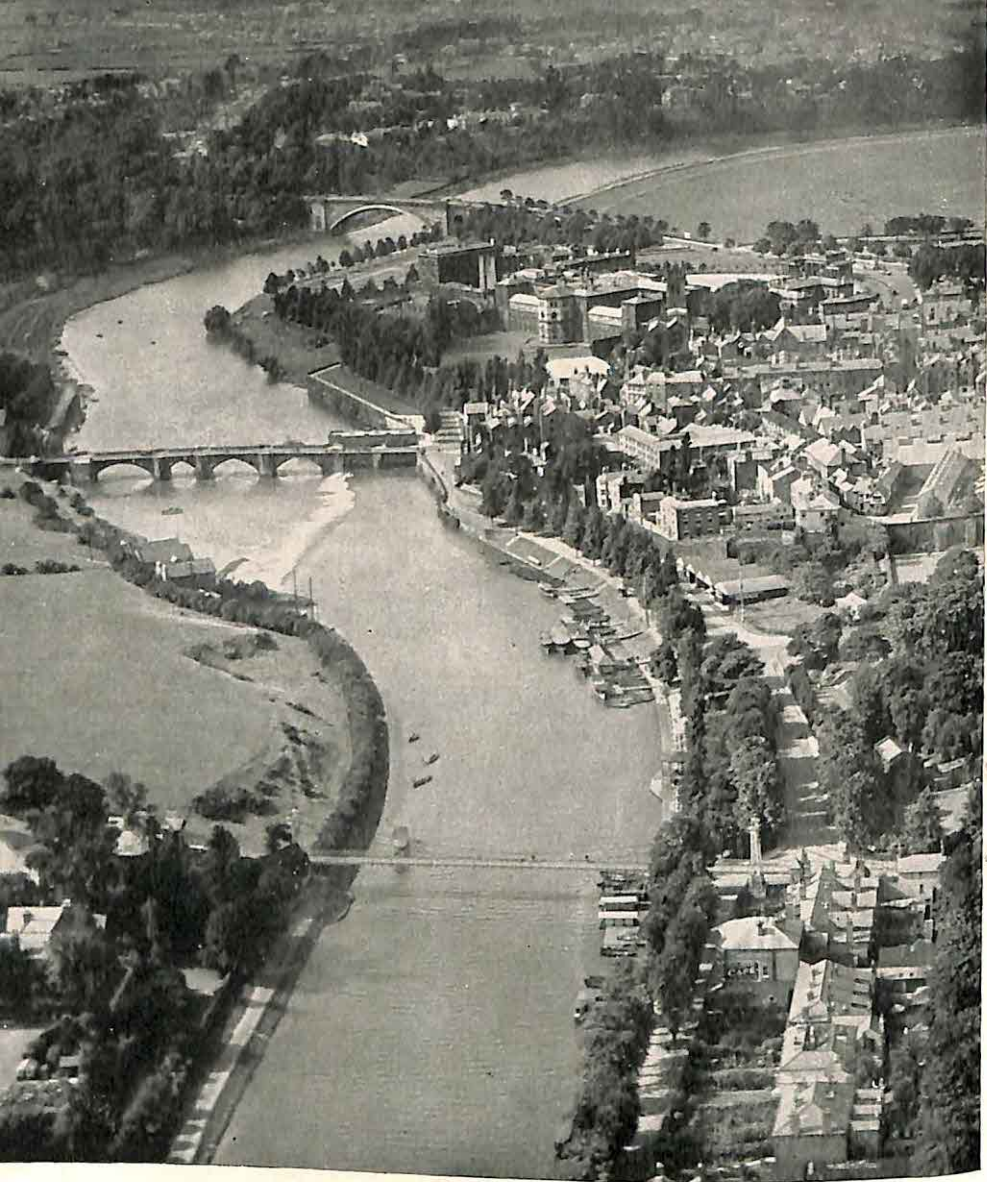
1. The Air and You.
2. Water and Life.
3. The Weather and the Earth.
4. Life and Food.
5. Health.
6. Energy and Engines.
7. Hearing and Seeing.
8. Electric Currents.
9. Magnets and Electric Power.
10. Earth and Universe.
11. Heating and Cooling.
12. Birth and Growth.
13. Metals and Man.
14. Atoms and Nuclear Power (*in preparation*).

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Chester and the River Dee

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Water and Life

WE have found in our study of air that we can as scientists discover a lot about something which is very common. Water is also one of the commonest things in the world. We have found that all living things must have air. All living things must also have water. So in this Unit you will be thinking, in the way of a scientist, about another common thing. Let us begin by thinking about where water is found.

Problem A: **WHERE DOES WATER OCCUR?**

Water is one of the commonest things in the world, but it is not equally common everywhere. If you live in Britain you can easily find a river or stream or pond within a mile of your home. But you can travel for hundreds of miles in Australia or North Africa without finding any river or pond in which there is always water. If you live in Britain, your home must be within 100 miles of the sea. But you could have a home in parts of the United States or Russia or China where the nearest sea is over 1000 miles away. Or you could be on a ship in parts of the ocean where the nearest land is far more than 1000 miles away. If you live in Britain, you know that there will almost certainly be some rain during the next few days. But there are some places in the world where you could not be certain that there will be any rain at all during the next two or three years!

Question 1. Where is the Earth's Water Found ?

Water covers nearly three-quarters of the surface of the earth. Most of this is in the Oceans. Figure 1 shows that all the land in the world could be fitted into the Pacific Ocean alone.

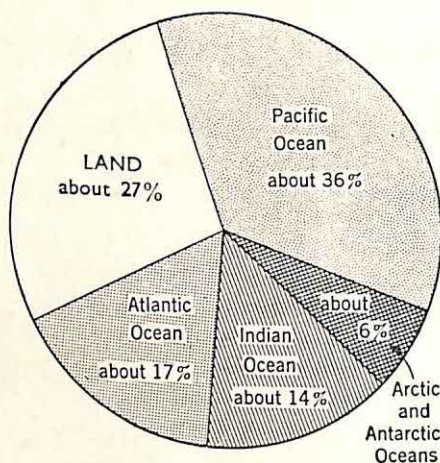


FIGURE 1.

Besides being very wide, the oceans are also very deep. Around lands like Britain there are shallow seas, but on six-sevenths of the ocean the bottom is more than a mile below the surface. Soundings in the Pacific Ocean have proved that at one place the sea is seven miles deep. The highest mountain in the world, Mount Everest, could be sunk in the ocean here and its summit would still be a mile below the surface. If all the oceans were spread out evenly over the globe, they would make a layer of water three miles deep.

Though the oceans contain most of the earth's water, there are also all the lakes and rivers. Some are very large. The Great Lakes of North America are as large as Britain. The Missouri and the Amazon Rivers are

both over 4000 miles long. But there is a lot of water in all the small rivers and streams. Every year at least 20 inches of rain falls on every acre of land in Britain. This means that at least 2000 tons of water falls on every acre in Britain every year.

We know that the rain comes out of the air, and that the air may be damp even if it is not raining. The moisture in the air is also part of the earth's water.

Is there water below the surface of the earth? Every spring and every well is proof that there is. And in Iceland and New Zealand and the Yellowstone Park in the United States you could watch the geysers blowing tons of water into the air. So we can answer our question by saying that there is water *on* the earth's surface, *above* it, and *below* it.



High Commissioner for New Zealand

FIGURE 2. Pohutu Geyser, Rotorua.

SOME THINGS YOU MAY CARE TO DO

1. Underground water may sometimes flow to the surface if a pipe is sunk to the level where a porous rock holds water. Such a thing is called an artesian well, the name coming from Artois, an old province of France, where such wells were common long before they had also been found in other parts of the world. A special arrangement of the beds of rock is necessary

for artesian wells to be possible. You can make a model by using Figure 3 for the idea and a box with a glass front to hold the materials. See how good a model you can make. Clay may serve for non-porous rock and sand for porous rock. How do you have to arrange the beds and the water supply so as to make sure that the water in the well rises to the surface of the land?

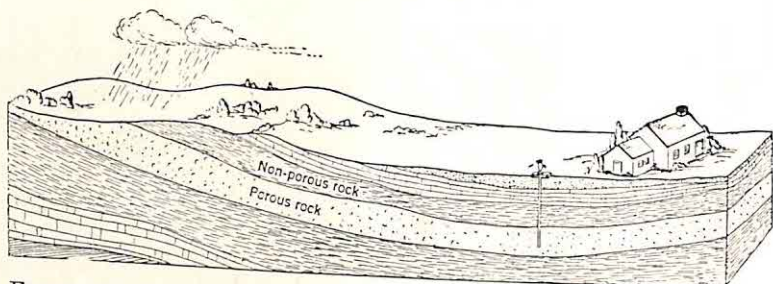


FIGURE 3. Layers of porous and non-porous rock with flowing well.

Can you see that the top of the porous rock layer is well above the level of the land at the spot where the well was sunk?

2. Make a collection of pictures which show that there is water on the surface of the earth, above it, and below it.

Problem A: Where does Water Occur?

Question 2. **Is there much Water in All Living Things?**

The world of living things is so extensive that we cannot hope to answer this question by a series of experiments. We can, however, use a few samples of living things for one or two experiments.

Use a test tube fitted with a bent glass tube as shown in Figure 4. Place some material from living plants in it, such as pieces of beet, or carrot, or roots of a plant. Heat the tube gently. You will find that

water drips from the tube into the beaker. In the same way you can test other plant materials, such as a small piece of banana, or apple, or potato. To test whether animal tissues contain water, you can use a small piece of meat (animal muscle), or egg.

Do the plant materials tested yield water?

Do the animal materials tested yield water?

Is it advisable to heat an empty test tube also, as a control? Why?

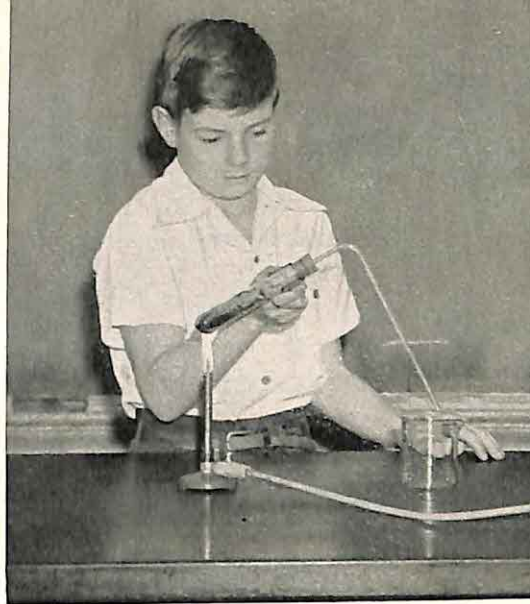


FIGURE 4. Heating pieces of beet produces water.

WATER IN LIVING THINGS

Your experiments have shown you that there *is* water in the particular living things, or materials that came from living things, which you tested. But are you justified in concluding that there is water in *all* living things? Do the experiments tell you anything about *how much* water these living things contain?

To learn the whole story we must turn to the work of other scientists who have found—by careful, accurate weighing and measuring—the exact amount of water in hundreds, even thousands of substances.

The amount of water in animal bodies varies greatly. Nearly two-thirds of your own body is liquid, while a jellyfish is 98 per cent water. The amount of water in plants also varies. Potatoes are 78 per cent liquid, green peas are 74 per cent, and lettuce is 95 per cent. Even a piece of wood, such as you burn in your fire-

place, will sometimes sizzle when it gets hot. Often you can see the drops of liquid coming out. We may conclude, then, that water is necessary to life, both in plants and in animals, including men.

SOME THINGS YOU MAY CARE TO DO

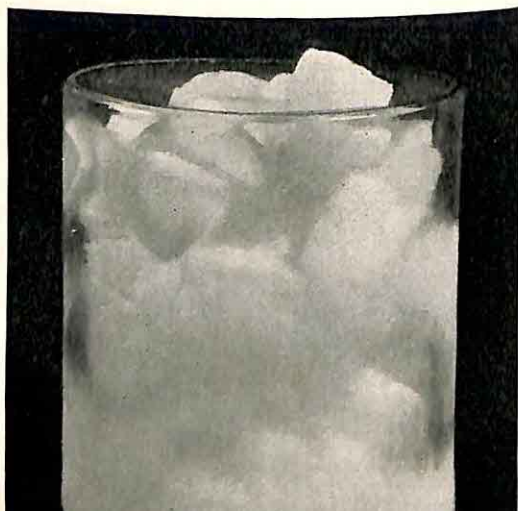
1. Balance two potatoes on scales. One of the potatoes should first be peeled. If they do not balance exactly, add sand to the pan which holds the lighter of the two. Next day notice whether they still balance. If not, why not? Does this experiment show you one effect of the potato skin?

2. Try to find out how much water your dog or cat drinks. *Hint:* To be sure that the water does not disappear just because it dries up, measure into each of *two* dishes the same amount. Place one dish where your pet may reach it, and the other dish where it will remain undisturbed. Keep a record of the experiment for several days. Each time you change the water, measure first the amount left in each of the dishes. By comparing the two dishes, you will be able to get an idea of the amount of water drunk.

FIGURE 5. Notice the space between spout and cloud. Where is the steam?



FIGURE 6. Here is water in solid form.



Problem B : **HOW DOES WATER CHANGE FORM ?**

Although water is found almost everywhere and even in plants and animals, it does not always appear as a liquid. Figures 5 and 6 show water in three different forms. The first picture shows a cloud of so-called steam, but really it is not steam. It is a cloud of tiny drops of liquid water. Real steam is invisible. There is steam in the upper part of the kettle, and some of it has come out into the air, but you cannot see it. When the steam changes to liquid water, as it does a little way from the end of the spout, it becomes visible. In the next picture the chunks of ice are solid water. Snow, too, is solid ; so are the hailstones shown in Figure 7. Water, then, can exist in three different forms, or *states* : as a liquid, as a gas or vapour, and as a solid.

Problem B: How does Water change Form ?

Question 1. **Is Water always Wet ?**

You may think this a silly question. Of course the answer is " Yes," you say. As scientists, however, you are ready to accept what you can learn from experiments. You are prepared to postpone making your conclusion until sure of all the facts you can find.

Let us start, then, with some simple experiments. First, let us boil some water, either in a glass beaker or in a small saucepan. After it is boiling briskly, hold a *cold* glass funnel over the dish. What appears on the glass funnel ?

Keep the dish over the heat until the water boils away.

*Was the water wet to start with ? Where did it go ?
Could you see the water in vapour form ? Was the
moisture on the glass funnel water-vapour or liquid water ?*

For our second experiment let us freeze some water ; in other words, change it from the liquid form to the solid form. Pour a few drops of water into a shallow dish, such as a watch glass. If the weather is cold enough, you can put the glass outdoors. In warm weather good results may be obtained by putting the watch glass, or a test tube with a little water in it, on a mixture of cracked ice and salt, or cracked ice and methylated spirit.

What change takes place in the water ? After the ice is fully formed, touch it. Is it wet ?

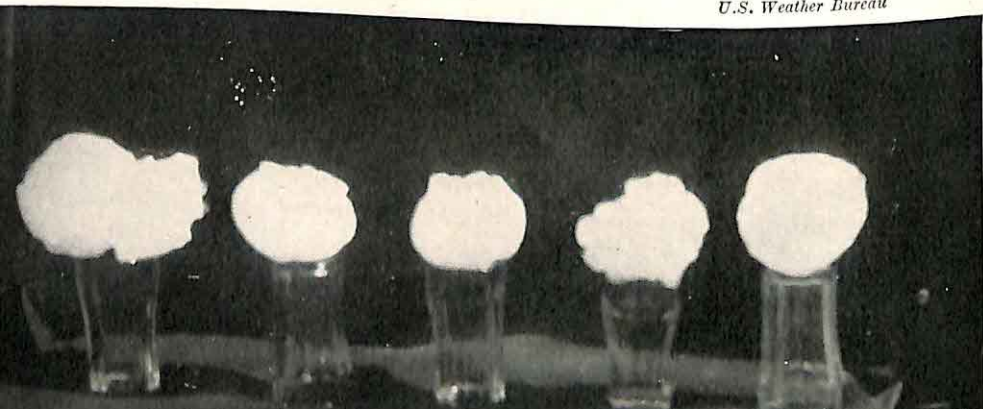
EVAPORATION AND CONDENSATION

From these experiments you learn that water can change its form. It can disappear from view as it changes from a liquid to a gas or vapour. In one case you used heat to cause the change to take place rapidly. Water, however, is constantly changing from the liquid state to the vaporous state. We call the process *evaporation*. You know that if you leave a saucer of water for your dog or cat, the water will disappear, whether or not your pet drinks it.

The change from liquid water to water-vapour is *evaporation*. The opposite change, from vapour to

FIGURE 7. These iceballs, hailstones as large as snowballs, fell in Nebraska in the U.S.A. a few years ago.

U.S. Weather Bureau



liquid, is called *condensation*. Where does the moisture on the outside of a jug of iced water come from? Have you ever noticed such moisture on the outside of your glass or bottle of cold drink? Water-vapour in the air *condenses*, changing from a dry vapour to tiny droplets of liquid water.

When a tray of ice cubes has come straight from the refrigerator, you can touch the ice without wetting your finger. If the tray is left on the table, however, it will not be long before the ice begins to melt. The dry, solid form—ice—changes to the wet, liquid form.

You are now ready to answer the question. You have found that there are three forms of water and only one is wet. The pictures show water in various states. What other pictures can you find, showing water as a liquid, a solid, or a gas or vapour?

SOMETHING YOU MAY CARE TO DO

Pour a cupful of water into a bottle, another cupful into a tumbler, and another cupful into a soup plate. Observe the results for several days. From which container does the water evaporate most quickly? Most slowly? Can you account for these results?

Problem B: How does Water change Form?

Question 2. **How are Clouds Formed?**

In your last question you boiled water, causing it to change rapidly from a liquid to steam. Steam is water-vapour at the boiling point. As it cools, it soon changes from its invisible form to a cloud of tiny drops of liquid.

Evaporation, the slower change from liquid water to vapour, is always going on all over the world. You probably know a pond or lake in which the water level

varies. In time of drought so much water evaporates that the level sinks far below normal.

The water which is constantly entering the air is in the form of vapour. But clouds are not composed of vapour. They are made up of droplets of liquid water. If, on a hill or mountain, or in an aeroplane, you pass through a cloud, you seem to be in a dense, wet fog.

You can perform an experiment to show how clouds are formed. The apparatus is shown in Figure 8. Pour a little water into a flask. The air above the water contains vapour, evaporating from the water surface, but, of course, it is invisible. Drop a burning match into the flask. This is to furnish smoke, which makes it more likely that the water will condense. Now insert the stopper fitted with a bent glass tube, attached to a piece of rubber tubing. Blow through the rubber tubing as hard as you can, squeeze or clamp the tubing to retain the air, and then release it *suddenly*. A small cloud should appear inside the

FIGURE 8. Blowing into the tube.



FIGURE 9. Why does the cloud form in the bottle?



flask. This experiment shows the three things necessary for the formation of a cloud—water-vapour, smoke or dust, and expanding, cooling air.

When did the cloud appear?

CLOUDS

Kinds of clouds. Clouds give our days variety and beauty. Yet no attempt was made to name them and classify them until a little more than a hundred years ago. Then simple Latin names were given to four distinct types of clouds. *Cirrus* means “lock” or “curl,” and refers to the high, white wisps of clouds seen on fair days. *Stratus* means “layer,” and is used for any cloud that spreads over the sky. *Cumulus* means a “heap,” and describes the billowing masses of white clouds that people call thunderheads. *Nimbus* means “rain cloud,” and refers to any cloud from which rain or snow falls.

Dew, frost, and fog. Do you know why water-vapour sometimes turns into clouds, sometimes into fog, sometimes into dew, and sometimes into frost? In every case the condensation is caused by cooling. Clouds usually form in the cool upper air. Fog, dew and frost form near the ground, because the ground cools rapidly and the moisture condenses. A thin layer of air next to the ground is cooled by contact with the chilled surface. Dew or frost forms from the condensation of moisture on a cold object. If the temperature is above the freezing point, dew forms; if below, frost forms. The tiny crystals of ice which condense as frost are often arranged in beautiful patterns. If the cooling of the air extends for some distance above the ground, the water-vapour may condense as fog.



FIGURE 10. Cirrus clouds.

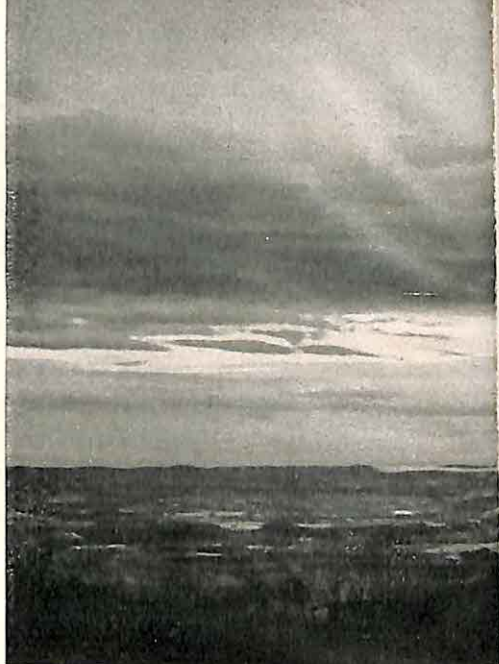


FIGURE 11. Stratus clouds.



FIGURE 12. Cumulus clouds.



FIGURE 13. Nimbus clouds.

The water on the earth, you have now learned, is changing form continually. Now solid, now vapour, now liquid, its form depends very largely upon the temperature of its surroundings.

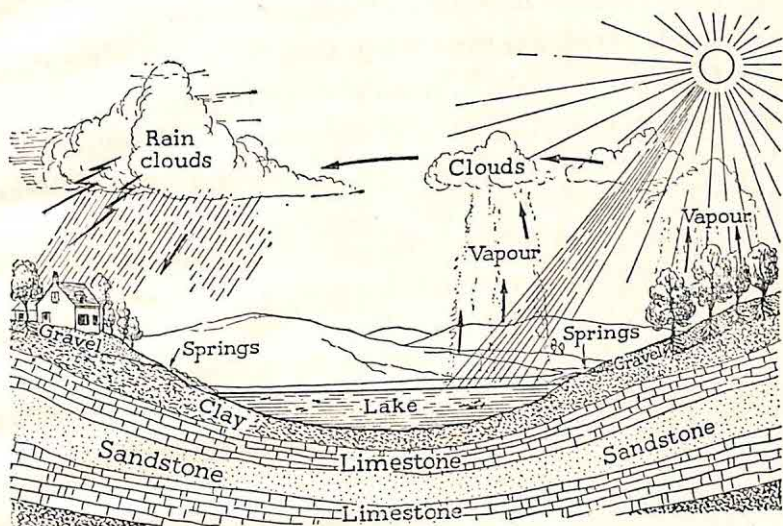


FIGURE 14. The water cycle. What changes of form are shown ?

SOMETHING YOU MAY CARE TO DO

Write a story about the life of a water drop, basing it upon the diagram in Figure 14.

Problem C: **WILL WATER DISSOLVE MOST THINGS?**

Having learned how water is distributed over the world, and something about the forms it takes, let us now consider ways in which it is of use to us. One of these depends upon the fact that many things, such as common salt or sugar, can be dissolved in water. The water that falls to the earth as rain is just water—pure water, we say. You would naturally think that this would be the best sort of drinking water, but have you ever tasted it? How flat it seems! Drinking water

tastes good when it has something else in it. In fact, when it has the right substances in it, it is better for our health than pure rain water.

Problem C: Will Water Dissolve most things?

Question 1. **What are some things that Water can Dissolve ?**

When rain water falls upon the earth some of it sinks in, and some of it flows over the surface. It picks up tiny particles of the earth as it moves along. Some particles can be seen ; they make the water muddy. But others are invisible. Water may contain them and still appear clear and sparkling. We say that these invisible particles are *dissolved* in the water. Water with such particles dissolved in it is called a *solution*. Anything that can be dissolved is said to be *soluble*. It is well to understand the meanings of these three words.

An experiment will show you more clearly what a solution is. We might use many different substances for the experiment, but let us choose tea leaves. Place some of the leaves in the bottom of a clear glass beaker or large test tube, and add *hot* water. As you watch the liquid in the glass, you notice that it begins to change colour. Does the yellow spread instantly or slowly ? In time you will find that the liquid is all one colour.

Next we shall try to find out whether the coloured substance can be removed from the liquid by *filtering* it.

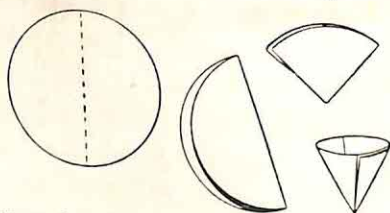


FIGURE 15. Steps in folding filter paper.

Fold a round piece of filter paper as shown in Figure 15 and place it in a small glass funnel, so that no liquid can pass down the funnel without going through the paper. Place the funnel in a test tube, and pour some of the tea solution through it. Examine the liquid that runs through. Can you tell by its *colour* and its *taste* whether there is tea in it? Can you see any particles floating in it, or is it a clear liquid?

Our last test will be to see if the solution changes if it is left a day or two. Does the tea settle at the bottom?

What three things about a solution have you learned?

SOLUTIONS

Many experiments made with different materials show that all solutions have certain things in common: (1) The liquid is clear, showing no particles. (2) The dissolved substance cannot be filtered out. (3) The dissolved substance is spread all through the liquid and does not settle to the bottom.

You may like to learn about some other substances that will dissolve in water. You may use test tubes, or bottles, as in Figure 16. Each bottle is first filled with warm water. In each of six bottles, put a teaspoonful of some substance. Do not add any substance to the seventh bottle. After the bottles have been shaken well, let them stand for five minutes.

FIGURE 16. How many of these substances dissolve in water?
(1) Salt. (2) Sand. (3) Powdered Chalk. (4) Iron filings. (5) Iodine. (6) Potassium Nitrate. (7) Water alone.



Make notes on what you see and then leave the bottles untouched until the next lesson.

Can you tell which substances dissolved in the water ?

Why did we use one bottle with no substance added to it ?

Useful solutions. Water which has substances dissolved in it may be more valuable than pure water. All living things, both animals and plants, use their foods in the form of solutions. Potassium nitrate, for example, is a desirable plant food. It must be dissolved in water before it can be taken in by plant roots.

Iodine is a substance that is necessary for our health. People who live in regions where there is little iodine dissolved in the water are likely to develop the disease called *goitre*, unless they add iodine to their diet in some other way. It has recently been found that people who live in regions where the drinking water contains a little dissolved fluorine have teeth which are more resistant to decay.

Some things dissolve slowly. The results of your experiment may have led you to think that sand and powdered chalk are not soluble. You could still see the particles at the end of the five-minute test. Remember, however, that a true scientist is not hasty in coming to a conclusion. Suppose you were to leave the materials in the water for days, even for months or years ? The fact is that even the hardest rocks, if soaked in enough water for long periods, will dissolve. Metals, such as iron, will do the same thing if given enough time. In fact, water dissolves so many things that it has been called the universal solvent.

Sea water. Sea water contains many substances in solution. If you have ever gone swimming in the sea, you know from experience that it contains salt. Do

you like the briny taste ? In addition to common salt, chemists have found many other substances in sea water. Of these some of the best known are iodine, aluminium, iron, gold, silver, and even radium.

SOMETHING YOU MAY CARE TO DO

Find out how many of the articles from the pantry shelf at home will dissolve in water.

Problem C: Will Water Dissolve most things?

Question 2. How can Dissolved Minerals be Taken from Water ?

You have seen that substances dissolve in water. If you wish to get them out of solution again, what can you do ?

The shallow glasses shown in Figure 17 each contained a teaspoonful of the liquids from the bottles shown in Figure 16. To hasten the evaporation of the water, they were heated gently on a sheet of asbestos over a flame. The same results could be reached, more slowly, by leaving them on a hot radiator. After the water evaporated, the dissolved substances were left behind.



FIGURE 17.

*Which, if any, of the substances tested failed to appear ?
Did the water which had nothing added to it show that
something was already dissolved in it ?*

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REMOVING SUBSTANCES FROM SOLUTIONS

The experiment shows that one way of obtaining dissolved materials from water is to evaporate the water. Salt may thus be obtained from sea water. In caves, where water evaporates slowly, the minerals are sometimes left behind.

Water that contains much dissolved mineral matter is known as *hard water*, which is usually undesirable. If you live in a region where the water is hard, you will probably find that the kettle has a coating on the inside. This is really rock which was dissolved in the water. When water boils, only the pure water leaves it as steam; the minerals are left behind, forming the scale in the kettle. Hard water makes hard work. Washing with it is unsatisfactory. It is necessary, therefore, to get these minerals out of solution. Removing them by evaporation is not practical. Soap or other chemicals, known as *water softeners*, are often used. The minerals appear as part of the scum which you may have seen in baths or washbowls.

You see that the problem of getting the hardness out of water is different from the one of getting salt from sea water. In the first case we wish to use the salt; in the second case we wish to use the water. How, then, will you answer the problem-question?

SOME THINGS YOU MAY CARE TO DO

1. Get some alum at the chemist's. Dissolve it in hot water and pour the solution into a tumbler. If you then smear the part of the tumbler above the liquid with vaseline, the experiment will work better. The alum will come out of the liquid in the form of crystals, as the solution cools and some of the liquid evaporates. Figure 18 shows crystals formed on two strings, each of which had a paper clip on the end.

2. Dissolve as much sugar or salt as you can in a cup of hot water. Then try to get the sugar or salt back again. What method will you use?

3. Crush a few crystals of iodine and dissolve them in about a dessertspoonful of Thawpiti. Pour the solution on a dinner-plate and make it spread. Watch carefully: smell the deposit and observe the plate with a lens at intervals of five minutes. Can you explain what happens?

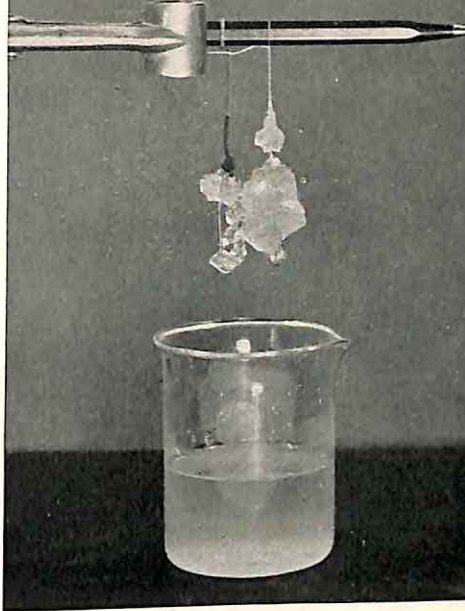


FIGURE 18. Alum crystals

Problem C: Will Water Dissolve most things?

Question 3. Can Water Dissolve Gases?

You have already seen that water will dissolve solids. Will it dissolve a gas? No doubt you have noticed that an ordinary glass of drinking water which has stood for an hour or two has little bubbles on the inside of the glass. These are air bubbles.

To find out whether warm water or cold water holds more air, fill two bottles, one from the hot-water tap and the other from the cold-water tap. Does your result agree with that shown in Figure 19?

What does this experiment show that will help in answering the problem-question?

FIGURE 19. The left-hand bottle contains warm water. What causes the cloudiness on the shoulders of the other?



GASES IN WATER

At first thought it may seem impossible that a gas can be *in* a liquid. But you have many times seen proof that gases come out of liquids. Perhaps you have tried to boil some water quickly and have been impatient at having to wait a few minutes. Bubbles began to rise to the surface, and perhaps you thought that the water was boiling. But those first bubbles were air, not steam. This shows that air at least is commonly dissolved in water.

Even while raindrops are falling through the air, they are able to dissolve small quantities of oxygen and carbon dioxide. So if we think of "pure" water as having nothing dissolved in it, we cannot say that rain water is absolutely pure, after all.

In making "mineral waters," carbon dioxide is dissolved in water. When you open the bottle, you see the bubbles of gas rising to the top, sometimes so fast that the bottle overflows with foam. But before you opened the bottle, you could not see the gas at all.

How has answering the questions helped you to solve the problem: Will water dissolve most things?

SOME THINGS YOU MAY CARE TO DO

1. Collect some carbon dioxide from lemonade, or other "mineral water."

FIGURE 20. How can you prove that the gas is carbon dioxide?



Figure 20 shows the apparatus. Heating the bottle by placing it in hot water causes the gas to escape more quickly. How many bottles of the gas can you obtain from one bottle of lemonade?

2. See how air dissolved in water changes its taste. First boil some water and allow it to cool. Boiling drives out the air that was dissolved in it. When you taste it after it is cool, you may not enjoy its flavour. Now pour some of the boiled water from a jug held at least a foot above the glass. Pour it through the air a number of times, and then taste it again. More air has now had a chance to dissolve in the water. Does it taste better ?

Problem D : HOW DO LIVING THINGS GET WATER ?

Having seen that living things contain water, let us now study some of the ways in which they obtain it. Many animals drink water. What kinds of animals have you seen drinking ? They vary a great deal in the amount they need at any given time. Camels, for example, can go for a long time without drinking, as you know. The reason is that they can store water in the walls of their stomachs. When a camel does drink, it takes in a large amount. Some other animals, rabbits for example, seldom seem to drink. They eat lettuce, however, and other soft watery foods. They get enough water for their needs in this way. Some animals need a very great deal of water, for instance cows which are giving milk. How does the good farmer arrange for this ? And do you know how birds obtain the liquid they need ?

Plants, too, need water. You have probably seen the wilted remains of a house plant that someone forgot to water. Flowering plants in gardens soon wither and die during a drought. Cut flowers soon droop if the stalks are not put into water. This seems to show that plants take in water and that to some extent their welfare depends on it.



Science Service

FIGURE 21. Single crown root of wild oat plant 80 days old. No other plants grew near this oat, so its roots had plenty of room to stretch out in deep fertile soil. Total length of roots shown here measures more than 300 miles.

Problem D: How do Living Things get Water?

Question 1. **How do Plants get the Water they Need?**

Plants have no mouths with which to drink. Most of the plants that you know, however, have a root system through which they get liquids. Some plants have an almost unbelievable amount of roots. The one wild oat plant shown in Figure 21

has over a thousand primary roots, and over ten million branch roots.

If you carefully dig up a weed from the roadside or garden, endeavouring not to break the roots, you may not find such a huge root system as shown in the picture, but you may be surprised to see how large it is. Wash off all the dirt and spread the roots out carefully on blotting paper or newspaper.

How many roots do you find?

Do you find few or many branch roots?

HOW PLANTS GET WATER

The passage of water through a plant. From the roots water passes up the stem of a plant to the smaller branches and so into the leaves. You may think of the trunk of a large tree as similar to a water main, carrying water and distributing it to the thousands of leaves as the water main supplies the houses of a town.

Have you ever seen a green carnation? One of those



FIGURE 22. Two carnations, green and white.

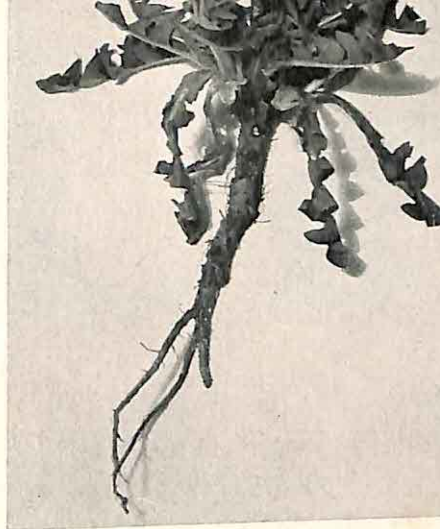


FIGURE 23. Dandelion showing long taproot. How is this root different from the root in Figure 21?

shown in Figure 22 was placed in a strong solution of green dye and left overnight. If you were to cut across the stem, you might be able to see the cut ends of the tubes, called *ducts*, which carry the liquid up into the petals of the flower.

Dandelions are among the most troublesome of our lawn weeds because their long root systems enable them to reach soil moisture not easily obtained by other plants near-by, such as lawn grass. So dandelions can get water from the earth even when the soil has dried out to quite a depth.

SOMETHING YOU MAY CARE TO DO

To show that plants give off water, place a glass jar over a healthy potted plant. After a time, perhaps half an hour, you may notice water on the inner side of the jar. Where did it come from?

The possibilities are: from the leaves, from the air, or from the soil. To find out which is the real source,



FIGURE 24.

you will need to use *controls*, as shown in Figure 24. One control is another potted plant, where the soil is covered with a rubber sheet. What source of moisture is thus shut out? The other control is a pot containing soil, but no plant.

Do all the jars show moisture?

Is the amount about the same?

Can you reach a conclusion as to its source?

Problem D: How do Living Things get Water?

Question 2. **How do We get the Water We Need?**

We all know how important water is for good health. One morning the newspapers told the story of a little five-year-old girl who was lost in the mountains for eight whole days. Hardly anyone expected that she would be found alive. But she *was* found, and although she had not had one bite of food, she had lost only about eight pounds in weight. What had kept her alive was the water she drank.

Water supplies. The problem of obtaining enough water for drinking, as well as for bathing, laundry, and all the other purposes for which it is used, is often a hard one to solve. Availability of a good water supply

was the reason why many villages and towns started to grow where they did.

Where does your water come from? Is it from wells, from a river, from a lake, or from springs? If water is piped into your house for family use, try to find out where it enters the house. Is it possible to shut off the supply? If so, where? Why might it be necessary to shut it off? Can you trace the pipes that supply the different parts of the house?

Water in our bodies. How do you get the water that you need to keep up the two-thirds of your body weight? Obviously, much of it comes from what you drink. When you drink milk, or eat eggs or lettuce, or even bread, you are taking water into your body. Soup is a fine source of water; so is ice cream; so are strawberries. There is no food which does not contain some moisture. It is not wise, however, to depend only upon the food. Most people drink too little water. It is a good plan to drink water between meals, not only occasional sips from a drinking fountain, but full glasses.

Water has many uses in our bodies. (1) It carries the food to all parts. Dissolved food passes through the walls of the digestive system into the blood, which is itself largely made up of water. The blood distributes the food to the body cells. (2) Some waste products are carried off by the blood and discharged from the body in water. (3) Water acts as a heat regulator in the body. When it evaporates from the skin as we perspire, it serves to keep us cool.

Have you noticed how thirsty you feel when you come in from a game of football or netball or even from skating in the winter? The more active you are, the more water you need. One way of telling how much you use is to measure the amount given off.

Scientists who have made many experiments and done careful weighing and measuring find that about one-third of this amount comes from the lungs in breathing. One scientist found that a person lost just twice as much water while singing as he did while resting. While doing light exercise, such as walking or riding a bicycle, he gave off ten times as much as when at rest !

SOME THINGS YOU MAY CARE TO DO

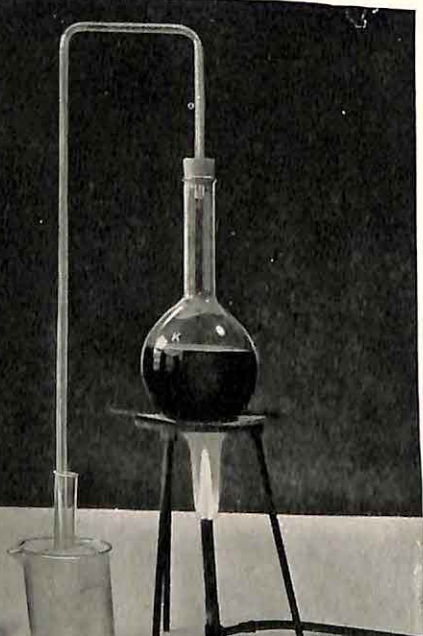
1. Visit the Water Department of your community and make a report on how water is supplied and purified.

2. One way of getting pure water is to *distil* the impure liquid. When the dirty water boils, no solids are given off. They are left behind. Figure 25 shows a simple distilling apparatus which you may be able to set up. The steam is condensed to water by cooling it. In this

FIGURE 25. One way of getting pure water from impure water. Keep the flame low.

apparatus the test tube is surrounded by ice. Keep the flame low to avoid "bumping" in the flask. You may need to support a piece of asbestos board between the flame and the ice.

3. Make a collection of pictures, showing ways in which water is used, such as in old water wheels, reservoirs, irrigation projects and canals. Write a short explanation to go with each picture.



REVIEW QUESTIONS

1. What are the four problems of this Unit ?
2. Name some different kinds of places in which living things are found.
3. Can life exist without water ?
4. How may you test for the presence of water ?
5. In what forms is water dry ?
6. How does evaporation differ from condensation ?
7. What are clouds ?
8. Name four kinds of clouds.
9. When does dew form ?
10. When does frost form ?
11. State three things that are true about solutions.
12. What are some of the substances dissolved in sea water ?
13. How can a substance be removed from a solution ?
14. What are some disadvantages in using "hard water" ?
15. Name two gases which dissolve in water.
16. About what proportion of your body is water ?
17. How do animals take in water ?
18. How do plants take in water ?
19. Name three uses of water in your own body.
20. How much water do we need ?

APPLYING WHAT YOU HAVE LEARNED TO EVERYDAY LIFE

Read each sentence and decide which set of words in brackets makes the statement true. Then write the true sentence.

1. The clouds that we see in the sky (are) (are not) a part of the earth.
2. The water in a well (could never) (may once) have been in the ocean.
3. We need to water our house plants because (the air is too hot for them) (water is constantly leaving them).
4. Wood burning in a fireplace sizzles because it (contains water) (is green).
5. (None) (All) of the following foods contain water : bananas, milk, nuts, meat.
6. It (is) (is not) a good plan to keep a dish of water for the use of our dogs and cats.
7. Trees have much water in them in summer ; after they are cut they have (some) (none).

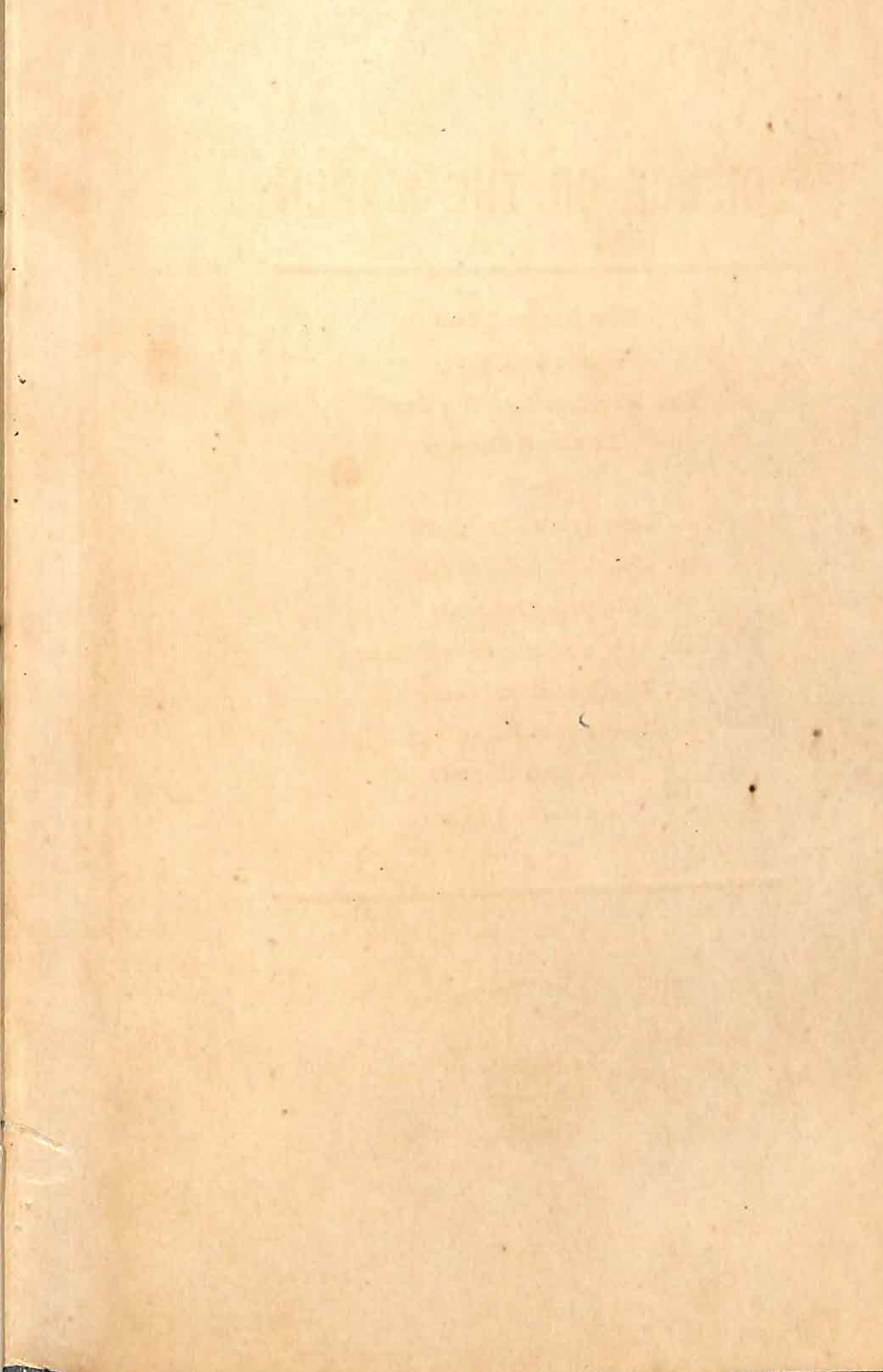
8. The moisture that forms on the outside of a glass of iced water comes from (inside the glass) (the air).
9. The moisture on the outside of a glass of iced water is (water-vapour) (water in liquid form).
10. We (can) (cannot) see real steam.
11. Ice which is not melting is (dry) (wet).
12. Clouds are composed of (water-vapour) (droplets of liquid water).
13. When water "boils away" on a stove, it (can) (can never) be liquid water again.
14. Fog is (a cloud near the ground) (water in vapour form).
15. Dew (falls from the clouds) (forms on objects near the ground).
16. Water is "hard" because (it makes hard work) (it has certain minerals in it).
17. Good water (may) (may not) contain air.
18. When drinking water looks milky, it is because of (bubbles of air) (minerals) in it.
19. The "fizz" in a bottle of lemonade is due to (air) (carbon dioxide).
20. Dandelions are hard to kill because they have (long taproots) (yellow flowers).

CAN YOU DECIDE WHAT FACTS ARE USEFUL?

A boy was put in charge of the plants in the school science room. Because he wanted to give the plants the best possible care, he bought some distilled water and watered the plants with that. Unfortunately, the plants did not grow well.

You probably know why the plants did not thrive. Suppose you had to explain why to the boy who was caring for them. You would use some of the facts listed here, but you would not use all of them. They are all true, but they are not all useful for your purpose. Check the facts you would use.

1. Water, ice, and steam are all forms of the same substance.
2. Distilled water is very pure water. It contains no minerals in solution.
3. When water is left in an open dish, it evaporates.
4. Plants need small amounts of minerals to grow properly.
5. The water we drink contains dissolved minerals.
6. Water is needed by all living things.



SCIENCE ON THE MARCH

The Air and You

Water and Life

The Weather and the Earth

Life and Food

Health

Energy and Engines

Hearing and Seeing

Electric Currents

Magnets and Electric Power

Earth and Universe

Heating and Cooling

Birth and Growth

Metals and Man



LONGMANS